AI-POWERED DEFORESTATION DETECTION

EXECUTIVE SUMMARY

Problem Statement

Deforestation remains one of the most pressing environmental challenges of our time, driving biodiversity loss and accelerating climate change. The European Union, recognizing the urgency, is responding with the EU Deforestation Regulation (EUDR), set to take effect in late 2025, which, when implemented, will require every retailer and importer to prove that their wood (and other wood-related agricultural products) does not contribute to deforestation. Companies that fail to provide sufficient evidence risk facing significant penalties, including fines or, in extreme cases, exclusion from the EU market. Yet, many businesses lack effective tools to reliably track this information across their supply chains - highlighting a strong business need for scalable monitoring solutions.

Proposed Solution

Our project addresses this gap by developing an AI-powered tool that uses satellite images to automatically detect forested areas and track changes in land cover over time. This solution serves as a foundation for deforestation monitoring, enabling companies to identify potential risks in their supply chains and demonstrate compliance with EUDR requirements.

Key Findings

- The AI model successfully segments forested and non-forested areas in satellite images, generating highly detailed segmentation masks.
- It outperforms baseline methods, providing accurate and reliable predictions that closely match, and some-times even surpass, the quality of the ground truth labels.
- Preliminary tests show that the model could be used to detect changes in forest cover over time using multi-year satellite image data.

Business Value and Recommendations

Our AI-driven land cover model translates satellite imagery into verifiable land-cover records. This offers companies the tools necessary to pass EUDR compliance checks. Because the method is scalable, once trained, it can be applied to any geographic area with available satellite imagery - from largescale plantations to small-holder farms. This enables a consistent workflow across entire supply networks, providing data-driven insights on deforestation risks for a wide range of companies, including retailers, importers, agricultural producers, and manufacturers sourcing forest-linked commodities.

We recommend adopting AI-based monitoring tools because they offer a cost-effective, scalable way to ensure regulatory compliance, reduce the burden of manual supply chain audits, and provide real-time visibility into deforestation risks. This not only helps businesses avoid penalties under the EUDR but also strengthens their sustainability credentials, meeting growing market and consumer demands for responsible sourcing.

Final Thoughts and Next Steps

This model demonstrates strong potential as an MVP foundation for deforestation monitoring. With a strong segmentation model in place, the next phase will focus on improving performance through higher-quality training data and applying the model to broader geographic regions. Additionally enhancing its ability to detect subtle land cover changes, such as forest thinnings, will be key to increasing its effectiveness. Future steps also include integrating time-series analysis to track changes over time and developing a user-friendly dashboard to make insights accessible to stakeholders. This tool has the potential to not only support regulatory compliance but also drive positive environmental impact at a global scale.

Highlights

- Addressed a relevant and critical environmental issue.
- Sucessfully implemented a relatively complex deep learning model (U-net) for semantic segmentation.
- Utilized High-Performance Computing (HPC) resources to conduct extensive model training with hyper-parameter sweeps for optimal model performance.
- Acquired satellite images on specific coordinates from the Google Earth API across multiple years.
- Project setup following best practices from MLOps with details gathered in a self-explanatory notebook.

Limitations

- Model does not yet support detecting forest thinnings, as these are very subtle changes in a satellite image.
- Scaling model to handle larger areas is needed for real-world use but is limited by insufficient annotated data.
- Model performance depends on image quality, and precise segmentation requires high-resolution satellite images, which can be costly or unavailable in some regions.
- Higher image quality will increase model complexity and extend training time.

Group 25